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ATSB TRANSPORT SAFETY REPORT
Aviation Occurrence Investigation AO-2006-153
Final

Loss of control
50 km north of Cairns Airport, Qld
2 December 2006

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Abstract

During an approach into Cairns Airport, Qld in overcast conditions late on the morning of 2 December 2006, the pilot of a Piper Navajo aircraft, registered VH-BTD, lost control of the aircraft and entered an uncontrolled descent. Control of the aircraft was regained shortly before the pilot became visual below the cloud base, and the pilot continued to Cairns.

The loss of control was the result of the pilot's inexperience with respect to the effects of spatial disorientation and with flight in instrument meteorological conditions (IMC).

This occurrence reaffirms the potential for spatial disorientation, if not recognised and recovered from appropriately, to result in the loss of aircraft control.

FACTUAL INFORMATION

The information presented below, including any analysis of that information, was prepared principally from information supplied to the Bureau.

History of the flight

On 2 December 2006, a Piper PA-31 Navajo (Piper Navajo) aircraft, registered VH-BTD, with the pilot the only person on board, was being operated on an instrument flight rules (IFR) ferry flight from Port Moresby, Papua New Guinea, to Cairns, Qld. At 1111 Eastern Standard Time[1], while manoeuvring the aircraft to intercept the localiser for a Cairns runway 15 instrument landing system (ILS) approach, the pilot lost control of the aircraft and entered an uncontrolled descent. The aircraft descended about 2,000 ft before control was regained.

The aircraft departed Port Moresby at 0822 that morning. The takeoff, climb to the cleared altitude of 8,000 ft above mean sea level (AMSL) and cruise were uneventful. The pilot advised that the cruise was conducted with the autopilot selected ON and that the descent and approach were flown manually.

Early in the approach, and for sequencing with other traffic, the pilot was requested by air traffic control (ATC) to lose 4 minutes. The pilot reported that, in order to achieve that time loss, he lowered the aircraft's landing gear and flaps. However, as that had the effect of '...reducing [the airspeed] to the blue line[2]', the pilot retracted the flaps. Air Traffic Control removed the timing restriction about 5 minutes later and the pilot retracted the landing gear.

1 The 24-hour clock is used in this report to describe the local time of day, Eastern Standard Time (EST), as particular events occurred. Eastern Standard Time was Coordinated Universal Time (UTC) + 10 hours.

2 Related to multi-engine aircraft, an aircraft's 'blue-line speed' is the airspeed for the best rate of climb following the failure of one engine (V_{YSE}).

The pilot stated that, shortly after, the aircraft encountered light turbulence, coincidental with its entering the tops of the cloud. The pilot was flying using the aircraft's instruments and found the intermittent changes from visual to in-cloud conditions distracting to his instrument flying.

After retracting the landing gear, the pilot noticed that the aircraft's heading had drifted and he attempted to regain the assigned heading by the application of a 10 degree angle of bank turn. The pilot believed that, during that turn, he became disorientated, lost control of the aircraft, and the aircraft entered a spiral descent. The pilot reported experiencing positive and negative g[3] during the loss of control, and recalled seeing a rate of descent of about 2,500 ft per minute during that time.

The pilot transmitted a MAYDAY[4] call to ATC and, shortly after, regained control of the aircraft. He exited the cloud, re-established visual reference with the horizon and continued to Cairns in visual meteorological conditions (VMC).

Post-flight inspection of the aircraft revealed that the battery had moved and there was engine oil on the engine cowls. No other aircraft defects were identified.

Recorded information

The recorded radar information and radio communications for the flight detailed the aircraft's ground tracking, ground speed and altitude[5] during the approach into Cairns. That included:

- The pilot was initially cleared to descend to 7,000 ft direct to CODIE, the initial approach fix for the runway 15 ILS.
- At 1105, ATC instructed the pilot to turn left onto a heading of 170 degrees, and to lose 4 minutes by CODIE. At that time, the aircraft was at 7,100 ft, with a ground speed of 120 kts.
- At 1107:05, ATC cleared the pilot to descend to 5,000 ft.
- At 1108:45, the pilot was instructed to turn right onto a heading of 190 degrees and to expect to intercept the localiser from that heading. At that time, the aircraft was descending through 5,900 ft, with a ground speed of 130 kts.
- ATC removed the time restriction at 1110:03, and cleared the pilot to resume his desired speed. The aircraft was in a slow descent through 5,500 ft, had a ground speed of 130 kts and was tracking 194 degrees at that time.
- From 1110:57 to 1111:37, the radar data indicated two 'porpoising events' by the aircraft. During the first event, the aircraft's altitude rapidly decreased from 5,500 ft at 1110:57 to 4,700 ft at 1111:02, before stabilising for 10 seconds and then increasing to 5,200 ft at 1111:17. During the lesser-amplitude second event, the altitude rapidly descended to 4,700 ft at 1111:22, before climbing to 4,900 ft at 1111:27, and again descending to 4,700 ft at 1111:32. The aircraft's altitude then stabilised at 4,700 ft for 10 seconds. During those events, the aircraft's track slowly drifted left from 194 to 153 degrees. The aircraft's radar-derived ground speed during the porpoising events was relatively stable at 140 to 150 kts.
- At 1111:18 the pilot transmitted a MAYDAY call indicating that he had: '…lost control in cloud MAYDAY pulling negative g'. That transmission coincided with the apex of the first porpoising event.
- At 1111:37, the aircraft was at 4,700 ft, with a ground speed of 140 kts and tracking 154 degrees. At 1111:42, the aircraft was at

3 1 g is the nominal value for vertical acceleration (that is, gravity) that is recorded when an aircraft is on the ground. In flight, g is a measure of the combined effects of flight manoeuvring loads and turbulence.

4 International call for urgent assistance.

5 An aircraft's recorded altitude was a combination of its reported raw Mode C altitude, and a system-processed altitude that was then displayed on The Australian Advanced Air Traffic System (TAAATS) equipment. Mode C was a coded transmission from an aircraft, in response to an interrogation signal from another station, which reported the aircraft's altitude with reference to a standard atmosphere.

2,700 ft, tracking 157 degrees, and had a ground speed of 160 kts.

- Over the next 10 seconds, the aircraft's altitude stabilised at about 2,800 ft, with its ground speed increasing to 210 kts, before reducing and stabilising at about 150 kts at 1112:30.
- A microphone was 'keyed'[6] at 1111:52, which appeared to be in response to an ATC transmission to the aircraft.
- The pilot reported 'visual' at 1112:00.

During the period from the pilot's MAYDAY call until he reported visual, ATC provided terrain avoidance advice and heading and altitude information.

Pilot information

The pilot was issued with a Commercial Pilot (Aeroplane) License in August 2003, a Command Instrument Rating in February 2004 and a Piper Navajo endorsement and instrument rating in July 2006.

At the time of the occurrence, the pilot had accrued 852 hours total flying time, of which 195 hours were completed in the Piper Navajo over the previous 6 months. The pilot had a total of 47.5 hours of instrument time, of which 13.5 hours were in the Piper Navajo. The pilot carried out 5.3 hours of instrument time in the previous 90 days and satisfied all of the experience and recency requirements affecting the flight.

Very little of the pilot's instrument time was in actual instrument meteorological conditions (IMC).

The pilot stated that, in the 24 hours preceding the flight, he had adequate rest and nourishment. The pilot felt fit and healthy for the flight.

Meteorological information

The Area Forecast (ARFOR)[7] for Area 45 forecast a broken (BKN)[8] layer of stratocumulus cloud with a base of 4,000 ft and tops at 7,000 ft. The 1100 Cairns METAR[9] reported the cloud conditions as FEW at 1,500 ft, SCT at 2,200 ft and BKN at 4,000 ft.

Spatial disorientation

The Australian Transport Safety Bureau (ATSB) research report titled *An overview of spatial disorientation as a factor in aviation accidents and incidents*[10] defined spatial disorientation (SD) as '…the inability of a pilot to correctly interpret aircraft attitude, altitude or airspeed in relation to the Earth or other points of reference.' Put more simply, SD was the inability of a pilot to tell which way was up. [11]

The ATSB research report cautioned that SD was '…an ever-present hazard to aircrew…' and alerted readers that '…the vestibular and visual illusions that can occur with this phenomenon can result in loss of situational awareness and aircraft control.'

Flight in IMC requires pilots to remain oriented through the interpretation of information derived from the aircraft's instruments. At the same time, erroneous or conflicting information is often being sent to the brain from the affected pilot's vestibular and proprioceptive (muscles, tendons, joints) systems. In the absence of good quality visual cues, the inappropriate, or lack of, use by a pilot of the available information from an aircraft's instruments increases the risk of that pilot becoming spatially disoriented.

Experience does not protect a pilot from SD, and prior experience of disorientation does not mean it won't ever happen again. However, as highlighted in the ATSB research report, a pilot's prior exposure to, and recovery from, disorientation does allow the disorientation phenomenon to be recognised more readily in the

6 Transmission of a carrier wave but no voice transmission.

7 ARFOR. For the purposes of providing aviation weather forecasts to pilots, Australia is sub-divided into a number of forecast areas. The occurrence took place in Area 45, which also included the seaward approaches to Cairns.

8 Broken meaning 5 to 7 oktas. The term okta is used to forecast or report the amount of cloud in an area, along a route or at an airfield. The numbers of oktas of cloud are reported as follows: Few (FEW), meaning 1 to 2 oktas; Scattered (SCT), meaning 3 to 4 oktas; BKN and Overcast (OVC), meaning 8 oktas.

9 A routine aviation weather report for Cairns at that time.

10 ATSB Aviation Research and Analysis Report – B2007/0063 (available at www.atsb.gov.au).

11 FAA Advisory Circular (AC) 60-4A of 2 Sep 1983.

future. Similarly, as pilots gain proficiency in instrument flying, they become less susceptible to the illusions normally associated with SD, and to their effect.

ANALYSIS

The weather conditions at the time of the incident were relatively benign and should have been within the capability of a pilot holding a Command Instrument Rating. That, the reported fitness of the pilot for the flight, and the apparent lack of any pre-incident aircraft defects, suggested that the incident occurred as a result of the operation of the aircraft.

A comparison of the occurrence as recalled by the pilot with the recorded information indicated that the pilot was not fully aware of the mechanics of the loss of control. That is not unusual in a spatial disorientation (SD) event.

The porpoising events preceding the loss of control were consistent with the pilot encountering difficulty handling the aircraft at that time. Although unaware of the specifics of those altitude excursions, they could have explained the pilot's report of experiencing positive and negative g.

The reported flight into and out of cloud would have contributed to the pilot's disorientation, which ultimately led to the loss of control and entry into an uncontrolled descent.

The pilot's inexperience in instrument meteorological conditions (IMC) and with SD, adversely affected his ability to identify that disorientation was affecting his ability to handle the aircraft.

This occurrence reaffirms that prevention is usually the best remedy for SD. Whereas a pilot can reduce his or her susceptibility to disorienting illusions through training and awareness, the fundamental criterion in overcoming SD is to trust and rely on the aircraft's instruments, and to disregard one's sensory perceptions.

FINDINGS

Context

From the evidence available, the following findings are made with respect to the loss of control involving Piper Aircraft Corporation PA-31 Navajo aircraft, registered VH-BTD, on 2 December 2006 and should not be read as apportioning blame or liability to any particular organisation or individual.

Contributing Safety Factors

- The pilot's low level of experience, both in instrument meteorological conditions (IMC) and with the effects of spatial disorientation, affected his capacity to identify the disorientating event.
- The pilot became disorientated before the loss of control.

SOURCES AND SUBMISSIONS

Sources

The sources of information during the investigation included:

- the pilot
- the Bureau of Meteorology
- Airservices Australia.

Submissions

Under Part 4, Division 2 (Investigation Reports), Section 26 of the Transport Safety Investigation Act 2003, the Executive Director may provide a draft report, on a confidential basis, to any person whom the Executive Director considers appropriate. Section 26 (1) (a) of the Act allows a person receiving a draft report to make submissions to the Executive Director about the draft report.

A draft of this report was provided to the pilot, Airservices Australia and the Civil Aviation Safety Authority (CASA). No submissions were received by the ATSB.